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MECHANICAL PROPERTIES OF SELF COMPACTING CONCRETE MADE OF BAGASSE ASH

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ABSTRACT - *Self-Compacting Concrete (SCC) is a highly workable concrete. It can flow under its own weight through congested reinforcement without any segregation and bleeding. In this work, the mechanical properties of SCC have been studied made of Bagasse ash.. The Bagasse ash was partially replaced with the powder content of 20%. After number of trials the final mix* ***(1:1.421:2.857)*** *was arrived as per IS code.10262:2009 and EFNARC specifications. The fresh and hardened properties of BASCC were found for varying percentage of super plasticizer (3% to5%) and Viscosity Modifying Agent (0.3%). The mechanical property of BASCC were found by casting Cubes, Cylinders. Specimens were tested with Compressive Strength, Split Tensile Strength. Totally nine cubes and cylinders have been cast of size 150mmx 150mm and 150 mm dia and 300mm height. Thus, the effect of BASCC with super plasticizer of 3.5%, 4% and VMA of 0.3% for constant bagasse ash content (20%) is obtained from the results of this experimental work. Finally at 3.5% a better result was attained.*

KEYWORDS :- self-compacting concrete, Bagasse ash, viscosity modifying agent, super plasticizer.

I. INTRODUCTION

1.1 SELF COMPACTING CONCRETE

The development of Self-Compacting Concrete (SCC) has recently been one of the most important developments in the building industry. The purpose of this concrete concept is to decrease the risk due to the human feature, to enable the economic efficiency, more freedom to designers and constructors and more human work. It is a type of concrete that can flow through and fill gaps of reinforcement and corners of moulds without any need for vibrations and compacting during the pouring process.

1.2 BAGASSE ASH

The Bagasse ash is an agro waste material. It is extracted from the sugarcane. When this waste is burned under controlled condition (below 700˚C for one hour), it gives the bagasse ash. The bagasse ash was used in this work is sieved through 90 μm sieve.

1.3 FINE AGGREGATE

Fine aggregate should be properly graded to give minimum void ratio and be free from deleterious materials like clay, silt content along with chloride contamination etc., Grading of fine aggregate should be such that it does not cause increase in water demand for the concrete and should give maximum voids so that the fine cementitious particles to fill the voids.

1.4 COARSE AGGREGATE

Coarse Aggregate consists of natural occurring stones (crushed, uncrushed or broken). It should be tough, strong, dense, durable, and clean. It should be roughly cubical in shape. Flaky pieces should be avoided. It should confirm to IS: 2383(I).

1.5 WATER

Water is an important ingredient of cement mortar as it chemically participates in the reactions by way of cement to form the hydration product, C-S-H gel.

1.6 SUPER PLASTICIZER (HIGH RANGE WATER REDUCER)

The super plasticizer used in concrete mix makes it highly workable for more time with much lesser water quantity. It is observant that by way of the use of large quantities of finer material (fine aggregate + cement + Bagasse ash) the concrete is much stiff and requires more water for required workability hence, in the present investigation glenium B233 is used as water reducing admixture.

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It is an admixture of a new generation based on **modified polycarboxylic ether** type. This chemical is added 1/3rd of water during mixing.

1.7 VISCOSITY MODIFYING AGENT

Glenium stream 2 is used as Viscosity-Modifying Admixture (VMA). It is specially developed for producing concrete with enhanced viscosity and controlled rheological properties. Concrete containing glenium stream 2 admixture exhibits superior stability and controlled bleeding characteristics, thus increasing resistance to segregation and facilitating placement. This can be added remaining 1/3rd of water during mixing.

2. EXPERIMENTAL WORK

2.1 MIX DESIGN METHOD FOR M_{20} GRADE

The procedures of the proposed mix design method for M_{20} grade can be summarized in the following steps. Initial mix proportion is calculated from the IS10262-2009.

The ratio is = 1: 1.421: 2.857

2.2 SLUMP FLOW TEST

Slump test is the most commonly used method of measuring workability of concrete. The apparatus for conduction the slump test consists of a metallic mould in the structure of a frustum of a cone.

Fig. 2.1 Slump flow test

2.3 L- BOX TEST

This test is based on a Japanese design for underwater concrete, has been described by Peterson. The test assesses the flow of the concrete and also the extent to which it is subjected to blocking by reinforcement.

Fig. 2.2 L-Box test

2.4 V-FUNNEL TEST

The test measures flow ability and segregation resistance of concrete.

Fig. 2.3 V-Funnel test

3. RESULTS DISCUSSION

3.1 RESULTS OF L-BOX TEST AND V-FUNNEL TEST

Table 3.1 Fresh concrete properties

S.No	Trial mix			Slump flow		V-funnel		L-box
	EFNARC Limitation			mm	$T_{500\,mm}$ (sec)	T_{10sec} (sec)	T_{5min} (sec)	H2/H1
				500-700	2-5	6-12	6-12	0.8-1.0
1	VMA 0.3 %	% of super plasticizers	2	445	-	-	-	-
2			3	580	6	14	13	0.75
3			**3.5**	**648**	**4.5**	**11**	**10**	**0.79**
4			**4**	**666**	**4**	**8**	**9**	**0.82**
5			4.5	682	5	6	5	0.83

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3.2 COMPRESSIVE STRENGTH TEST

The compression test is used to determine the hardness of cubical specimens of size 150mmx150mmx150mm. It was tested by using Compression Test Machine (CTM).

Fig. 3.1 Cube specimen under testing

Table 3.2 Compressive strength of the cubes specimens

S. No	% of Replacement bagasse ash	% of VMA	%of super plasticizer	Compressive strength N/mm²		
				7 days	14 days	28 days
1.	20	0.3	0	18.6	19.5	22.82
2.			3.5	18.3	19.4	21.74
3.			4.0	16.9	17.8	19.16

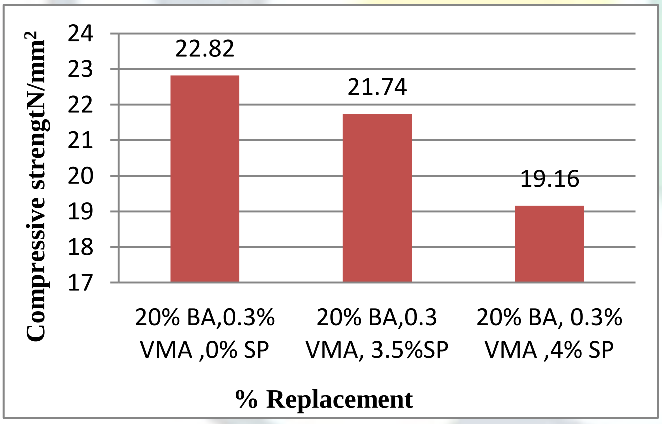

Fig. 3.2 Comparison of compressive strength at 28 days curing

3.3 TENSILE STRENGTH TEST

This test is carried out by placing cylindrical specimens (150 mm diameter and 300 mm height) horizontally between the loading surfaces of a compression testing machine and the load applied until failure of the cylinder, along the vertical diameter.

Fig 3.3 Cylindrical specimen under testing

Table 3.3 Results of tensile test for cylindrical specimen

S. No	% of Replacement bagasse ash	% of VMA	%of super plasticizer	Tensile strength N/mm²		
				7 days	14 days	28 days
1.	20	0.3	0	3.50	3.91	4.20
2.			3.5	3.33	3.57	3.89
3.			4.0	2.23	2.74	2.92

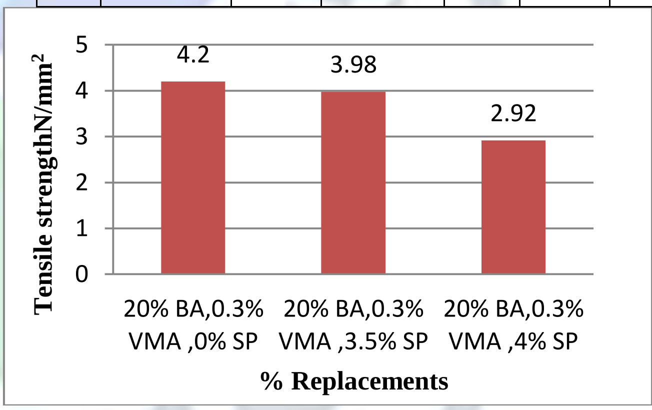

Fig. 3.4 Comparison of tensile strength at 28 days curing

4. CONCLUSIONS

- The final ratio (1:1.421:2.857) of self-compacting concrete was obtained. Fresh concrete properties are found as per EFNARC specifications. And then SCC specimens were cast for water cement ratio 0.4, SP 0%, 3.5%, 4.0% & VMA 0.3%, which are satisfied EFNARC specifications.
- Compressive strength, tensile strength was found for cubes and cylinders.
- The workability of concrete was maintained by adding of 0.3% of VMA. The 7, 14, and 28 day's compressive strength was high at 20 % of bagasse ash and 0.3% VMA and 3.5% super

plasticizer also the 7,14,and 28 day tensile strength was high at 20% of bagasse ash and 0.3% of VMA 3.5% of super plasticizer.

- The compressive strength of the cube increased by 8.7% when the cement was replaced by 20% of bagasse ash with 0.3% of VMA and 3.5 % of super plasticizer.
- The tensile strength of the cylinder increased by 55.6% when the cement was replaced by 20% of bagasse ash with 0.3% of VMA and 3.5 % of super plasticizer.
- The optimum percentage is found to be 20% at which the cement can be replaced by bagasse ash with 0.3% of VMA and 3.5% of super plasticizer.

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